

Matlab script

% calculates the cavity spectrum and the frequency distance between TEM₀₀ % and higher order modes m+n. Two curved mirrors possible. % % 1. Vers.: 14.03.12 , T.Legero % Revised : 19.11.13 , T. Legero , Two curved mirrors possible.

clear all; clc;

Len = 0.48; % cavity length in [m] Curv1 = 1000000000; % mirror no. 1 curvature in [m] Curv2 = 1; % mirror no. 2 curvature in [m] Refl = 0.99998; % reflectivity of mirrors c = 299792458; % speed of light [m/s]

FSR = c / (2*Len); % Free-Spectral-Range Gouy = FSR/pi*acos(sqrt¹⁾); % Gouy-Phase

% Finesse = pi*sqrt(Refl)/(1-Refl); % linewidth = FSR/Finesse;

fprintf('Cavity length L = %g m ⇒ FSR = %g MHz\n', Len, FSR/1E6); fprintf('Radius of Curvature R1 = %g m and R2 = %g m ⇒ Gouy = %g MHz\n\n', Curv1, Curv2, Gouy/1E6);

%fprintf('Reflectivity R = %g ⇒ Finesse F = %d \n ⇒ Linewidth d = %g MHz \n\n', Refl, round(Finesse), linewidth/1E6);

mn_max = 100; w_max = 100;

delta = zeros(mn_max, w_max);

for w = 1:w_max

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    for mn = 1:mn_max
        delta(mn,w) = w*FSR - mn*Gouy; % Freq.Diff. von (q-w)ter höherer
                                         % Mode mn zu q-ter TEM00-Mode
        if (abs(delta(mn,w)) < 10E6)
            fprintf('Freq. diff. of m+n = %g higher order mode to 00-mode is
%g MHz\n', mn, delta(mn,w)/1E6);
        end
    end
end

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end

%% plot

mn = 4; % Modenumber of Higher-Order-Mode to plot R = 0.95:0.01:1.05; % Vary Mirror-Curvature

G = FSR./pi*acos(sqrt(1-Len./R)); % Gouy-Phase %G = FSR./pi*acos(sqrt²⁾); % Gouy-Phase d = FSR - mn*G; % Difference between TEM₀₀ and TEM_{mn}

plot(R,G);

¹⁾

1-Len/Curv1)*(1-Len/Curv2

²⁾

1-Len./R).*(1-Len./R

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